2.(Twice-Amended) An apparatus for detecting the phase and amplitude of electromagnetic waves ~~, preferably~~ in the optical and ~~in the near~~ infrared and ultraviolet ranges, comprising at least two modulation photogates (1, 2) which are sensitive to the electromagnetic waves (photosensitive), and accumulation gates (4, 5) which are associated with the modulation photogates and which are not photosensitive or shaded, and electrical connections for the modulation photogates (1, 2) and the accumulation gates (4, 5), so that the latter can be connected to a reading-out device, and the former can be connected to a modulating device which increases or reduces the potential of the modulation photogates (1, 2) relative to each other and relative to ~~the~~ a ~~preferably constant~~ potential of the accumulation gates (4, 5) corresponding to a desired modulation function, characterized in that there are provided a plurality of modulation photogates (1, 2) and accumulation gates (4, 5) ~~in the form~~ being formed of long narrow parallel strips which group-wise form a PMD-pixel, wherein the accumulation gates are ~~in the form of~~ reading-out diodes with ~~preferably in each case~~ the cathode of each diode being a ~~as the~~ reading-out electrode, characterized in that the width of the modulation photogates is greater than the width of the accumulation gates.

3.(Twice-Amended) Apparatus as set forth in claim 2 characterized in that the width of the ~~individual~~ modulation photogates is of the order of magnitude of ~~the~~ a wavelength or, in particular for the remote infrared range, ~~also~~ less than the wavelength of the electromagnetic ~~radiation~~ waves to which the modulation photogates are sensitive.

4. (Third-Amended) Apparatus as set forth in one of claims 2 through 3 characterized in that ~~the~~ a strip length of the modulation photogates (1, 2) and the accumulation gates (4, 5) is more than ten times ~~and preferably more than fifty times~~ the wavelength of the electromagnetic ~~radiation~~ waves to which the modulation photogates are sensitive.

25. (New) Apparatus as set forth in one of claims 2 through 3 characterized in that a strip length of the modulation photogates (1, 2) and the accumulation gates (4, 5) is more than fifty times the wavelength of the electromagnetic waves to which the modulation photogates are sensitive.

5. (Third-Amended) Apparatus as set forth in one of claims 2 ~~through]~~ through 3 characterized in that there are provided a plurality of modulation photogates in paired parallel mutually juxtaposed relationship, wherein each of the modulation photogates (1, 2) of such a pair is connected to another modulation connection so that the modulation photogates (1, 2) are modulatable in push-pull relationship, wherein a respective accumulation gate (5, 4) is arranged between a pair of modulation photogates (1, 2) and a next adjacent further pair of modulation photogates (2, 1) and wherein the modulation photogates (1, 2) of the two pairs, which are immediately adjacent to a respective accumulation photogate (4, 5), are connected or electrically joined to the modulation connections in such a way that their modulation occurs respectively in push-pull mode.

6. (Previously Twice-Amended) Apparatus as set forth in one of claims 2 through 3 characterized in that a plurality of modulation connections (m_1, m_2, m_3) are arranged at substantially equal spacings along the length of the strips and are connected to the modulation photogates (1, 2).

7. (Third-Amended) Apparatus as set forth in one of claims 2 through 3 characterized in that the modulation photogates immediately adjoining the accumulation gates (4, 5), on ~~the~~ a side towards the accumulation gates, include ~~partially involve a covering by~~ a contacting strip of high conductivity and of no or very low transparency ~~for the electromagnetic waves~~.

8. (Third-Amended) Apparatus as set forth in one of claims 2 through 3 characterized in that the apparatus has one or more pixel units ~~elements~~, wherein ~~a~~ each pixel unit ~~element~~ is substantially square-shaped and comprises a plurality of ~~pairs of~~ strip-shaped modulation gates (I, 2) and accumulation gates (4, 5), which pixel units are assembled to form a pixel, wherein the strip directions of adjacent pixel ~~elements~~ units ~~at different modulation voltages~~ are ~~preferably~~ perpendicular to each other, wherein adjacent pixel units are at different modulation voltages, and wherein transversely with respect to the strip direction of a respective pixel unit the ends of the ~~pixels~~ strip-shaped modulation gates are defined by at least one respective modulation photogate (1, 2) which adjoins a next ~~inwardly disposed~~ accumulation gate (4, 5).

9. (Twice-Amended) Apparatus as set forth in claim 8 characterized in that the electrical connections for the accumulation gate ~~connections~~ are provided at a respective end of the strips of a pixel, wherein each second accumulation gate is connected to a first respective one of two reading-out lines (~~for example~~ corresponding to K+) and the other accumulation gates are connected to the respective other one of the connection lines (corresponding to K-), wherein the reading-out lines lead to an evaluation circuit.

10. (Third-Amended) Apparatus as set forth in claim 8 characterized in that two pixel units ~~elements~~ (10, 10') are arranged with their strips parallel and in directly mutually juxtaposed relationship so that ~~the~~ mutually immediately adjacent modulation photogates which define ~~the~~ mutually juxtaposed ends or sides of the two pixel units ~~elements~~ (10, 10') form a pair of modulation photogates (I, 2) which are modulatable selectively in push-pull mode or phase-displaced relationship, whereby either a single pixel element of double the size of one of the

two pixel units is formed or two independent measurement procedures, ~~for example~~ being of an in-phase signal and a quadrature signal, are possible with the two pixel units ~~elements~~.

11. (Third-Amended) Apparatus as set forth in claim 8 characterized in that there are four pixel units ~~elements are~~ arranged in a rectangle, wherein the strips of ~~the~~ pixel~~s~~ units which are respectively disposed in diagonally opposite relationship in the rectangle ~~respectively~~ extend parallel to each other, while the strips of ~~the~~ immediately adjacent pixel units ~~elements~~ extend perpendicularly to each other, and wherein ~~the~~ modulation connections are connected in such a way that modulation of adjacent pixel units ~~elements~~ (10) can be effected in phase-shifted relationship~~, more specifically preferably~~ through 90° ~~in each case~~.

12. (Twice-Amended) Apparatus as set forth in claim 11 characterized in that each of the four pixel units ~~elements~~ (10) is respectively of a substantially square shape and the four pixel units ~~elements~~ are assembled to form a square ~~or that the corners are additionally cut off in such a way that substantially an octahedron shape is formed~~.

13. (Twice-Amended) Apparatus as set forth in claim 12 characterized in that the four pixel units ~~elements~~ are selectively combined individually (4-quadrant operation) or doubly in diagonal relationship (2-quadrant operation) or in quadruple relationship (1-quadrant operation), wherein in the case of ~~4quadrant~~ 4-quadrant operation and 2-quadrant operation the gradient or normal vector of the surface ~~element~~ of the four pixel units is additionally evaluated.

14. (Third-Amended) Apparatus as set forth in claim 2 characterized in that the modulation photogates and the accumulation gates and ~~the~~ associated signal evaluation

peripheral equipment and modulation peripheral equipment are produced in part on-chip and in part as a multi-chip module using CMOS-technology or BICMOS-technology.

15. (Third-Amended) Apparatus as set forth in claim 2 characterized in that arranged over the modulation photogates (1, 2) are strip lenses which focus substantially all the ~~light~~ electromagnetic waves incident on the surface of a ~~'pixel~~ pixel element exclusively on to the modulation photogates (1, 2).

16. (Previously Twice-Amended) Apparatus as set forth in claim 2 characterized in that a plurality of PMD-pixels are arranged in a linear or matrix array.

17. (Third-Amended) Apparatus as set forth in claim 2 characterized in that in a linear or matrix array has both PMD-pixels with 3D-functionality and also conventional CMOS-pixels with 2D-functionality ~~are~~ used in mixed mode, wherein ~~the~~ various ~~and in particular~~ adjacent items of pixel information are passed to a data-fusioning and interpolating device for reconstruction of ~~the~~ a depth image.

18. (Third-Amended) Apparatus as set forth in claim 17 characterized in that ~~preferably there is~~ associated with each said PMD-pixel is a microlens which concentrates the ~~light~~ electromagnetic waves incident on the array ~~substantially on to~~ onto the photosensitive surface of ~~the individual pixels~~ that PMD-pixel.

19. (Previously Twice-Amended) Use of an apparatus as set forth in claim 2 characterized in that the apparatus is used as a photosensitive image-recording element in a camera.

20. (Previously Twice-Amended) Use of the apparatus as set forth in claim 2 characterized in that the apparatus is used in optical signal processing as a frequency- and phase-sensitive mixing or correlation element for signal acquisition, processing and noise suppression.

21. (Third-Amended) A method of operating an apparatus as set forth in claim 8 characterized in that a scene of which an image is to be produced is illuminated with a light modulated in accordance with a modulation function, wherein the modulation photogates (1, 2) are modulated with ~~the same but now~~ bipolar or push-pull modulation function and wherein, selectively for half of a 2-quadrant or 4-quadrant pixel, of the pixels 90° phase-shifted modulation is effected in the case of sine modulation or a bit width in the case of rectangular modulation or a chip width in the case of PN-modulation of the modulation photogate ~~voltages~~ potentials.

22. (Third-Amended) Use of an apparatus as set forth in claim 2 characterized in that the apparatus is used in an optical PLL-circuit or DLL-circuit which circuits are ~~is preferably~~ highly integrated and ~~is preferably~~ used in light barrier arrangements ~~, as a PLL-array in time lapse cameras, in optical remote controls and in data light barrier arrangements and for the regeneration of data signals in optical communications~~ with each including various modulation modes.

23. (Third-Amended) Use of an apparatus as set forth in any one of claims 2 and 3 characterized in that the apparatus is used in an optical PLL- or DLL-circuit with a 2Q-PMD-DLL on the basis of an IQ-PMD-receiver, ~~in particular~~ with PN-modulation, wherein digital PN-encoded data signals are used for multi-channel selection, multi-target detection and for highest sensitivity in phase transit time resolution, wherein ~~the~~ a difference output voltage is formed as ~~the~~ a difference of ~~the~~ quantitative differences of ~~the~~ photocurrents as U_Δ = const · ~~(I i_a-i_b) I - I i_c-i_d I)~~ (I i_a-i_b I - I i_c-i_d I) and is fed back by

way of a loop filter or a digital regulator as a control parameter of ~~the~~ a voltage-controlled multivibrator to ~~the~~ a chip frequency and wherein ~~the~~ a data signal of ~~the~~ a PN-encoded 1/0-data sequence is regenerated by means of ~~the~~ a recovered word clock by a procedure whereby in ~~the~~ a summing amplifier (41) ~~the~~ a sum of the differences of ~~the~~ photocurrents as U_Σ = const · ~~(I i_a-i_b I) - I i_c-i_d I)~~ (I i_a-i_b I + I i_c-i_d I) is respectively formed over a PN-word length by means of a short-term integrator contained in the summing amplifier.

24.(Amended) Apparatus as set forth in claim 16 characterized in that ~~preferably there is~~ associated with each said PMD-pixel is a microlens which concentrates the ~~light~~ electromagnetic waves incident on the array ~~substantially on to~~ onto the photosensitive surface of ~~the individual pixels~~ that PMD-pixel.

26. (New) Apparatus as set forth in claim 10, characterized in that the apparatus is used in an optical PLL- or DLL-circuit with a 2Q-PMD-DLL on the basis of an IQ-PMD-receiver, with PN-modulation, wherein digital PN-encoded data signals are used for multi-channel selection, multi-target detection and for highest sensitivity in phase transit time resolution, wherein a difference output voltage is formed as a difference of quantitative differences of photocurrents as U_Δ = const · (I i_a-i_b I - I i_c-i_d I) and is fed back by way of a loop filter or a digital regulator as a control parameter of a voltage-controlled multivibrator to a chip frequency and wherein a data signal of a PN-encoded 1/0-data sequence is regenerated by means of a recovered word clock by a procedure whereby in a summing amplifier (41) a sum of the differences of photocurrents as U_Σ = const · (I i_a-i_b I + I i_c-i_d I) is respectively formed over a PN-word length by means of a short-term integrator contained in the summing amplifier.